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# The effect of argon ion bombardment on the interfacial conductivity and corrosion resistance of amorphous carbon films on stainless steel bipolar plates for proton exchange membrane fuel cells

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Due to its unique physical and chemical properties, amorphous carbon (a-C) film has been widely used to enhance the surface conductivity and corrosion resistance of bipolar plates in proton exchange membrane fuel cells (PEMFC). However, the corrosion of bipolar plates is more significant at the high cathode potential during transient conditions such as stack start up and shut down process. This requires the quality improvement of a-C films. The structure, thickness and properties of a-C films are greatly depending on the process conditions during the film growth. In this study, we prepared a series of a-C films with different energetic argon ion bombardment by adjusting the voltage and duty cycle of linear ion source pulse power equipped on the direct magnetron sputtering system. X-ray Photoelectron Spectroscopy (XPS), Atomic Force Microscope (AFM) and Scan Electron Microscope (SEM) were used to examine the effect of argon ion bombardment on the hybridization and roughness of the a-C films. While for the level of corrosion resistance, the a-C films were evaluated by the potentiodynamic polarization and the potential holding tests in 0.5 M H2SO4 + 5 ppm HF. The interfacial contact resistance (ICR) before and after corrosion tests between the bipolar plates and gas diffusion layer was also measured. Through this study, we demonstrate that argon ion bombardment is an effective method for tuning the film structure and improving compactness of a-C films in-situ. Thus this capability has direct implication in the synthesis of ultra dense a-C films for the corrosion protection of bipolar plates especially in the highest cathode potential (1.5VSHE).

**Keywords**
ion bombardment
a-C film
corrosion protection
bipolar plate
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